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Liang et al.

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(54) **DECORATIVE DOOR SKIN COMPOSITE ARTICLE**

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Related U.S. Application Data

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B27N 7/00 (2006.01)

(52) **U.S. Cl.**
CPC ***B27N 7/005*** (2013.01); *Y10T 156/1002* (2015.01); *Y10T 156/1023* (2015.01); *Y10T 156/1039* (2015.01); *Y10T 156/1044* (2015.01); *Y10T 428/31982* (2015.04)

(58) **Field of Classification Search**
USPC 428/532, 535, 536, 537.1, 106, 151; 156/209, 219, 222, 307.4, 307.7, 312
See application file for complete search history.

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(57) **ABSTRACT**

A method of forming a composite article is disclosed that involves providing a press having first and second platens, a cellulosic fiber substrate having a first thickness, and a layer of material such as a wood veneer, foil, or non-creped paper, where the layer of material has a thickness less than the thickness of the cellulosic fiber substrate. A layer of bonding material is placed onto the cellulosic fiber substrate or the layer of material, and the layer of material is placed onto the cellulosic fiber substrate so that the bonding material is between the layer of material and the cellulosic fiber substrate. The cellulosic fiber substrate and layer of material are placed between the first and second platens, and at least one of the first and second platens is moved toward the other of the first and second platens to deform the cellulosic fiber substrate and layer of material into a predetermined configuration while bonding the layer of material to the cellulosic fiber substrate without cracking or wrinkling the layer of material.

11 Claims, 3 Drawing Sheets

Fig. 1

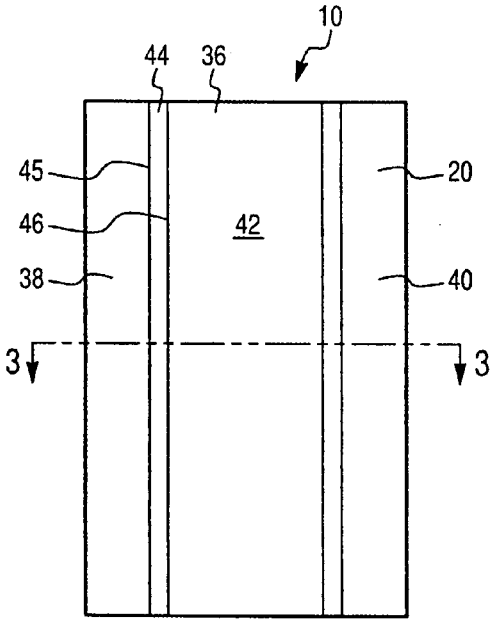


Fig. 2

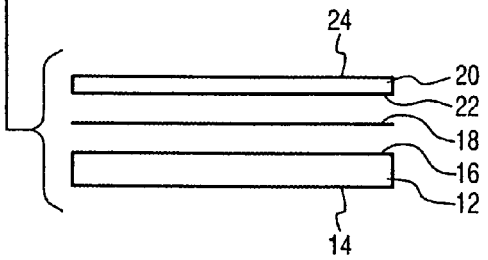


Fig. 3

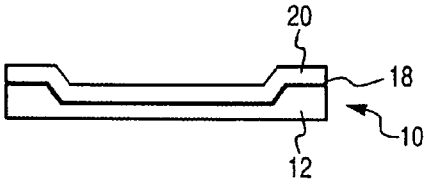


Fig. 4

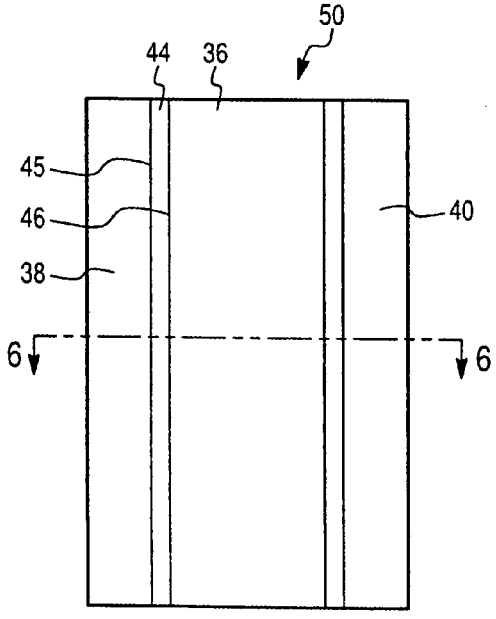


Fig. 5

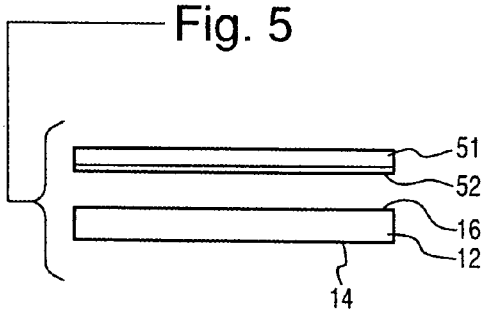


Fig. 6

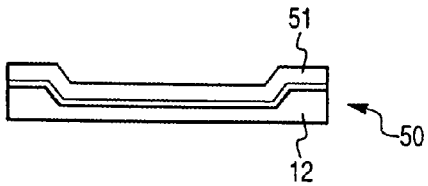


Fig. 7

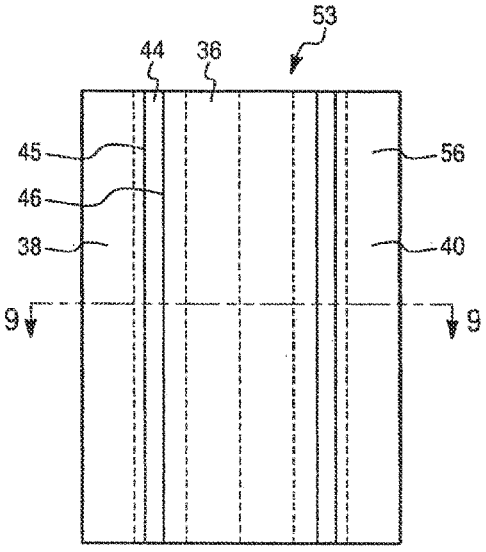


Fig. 8

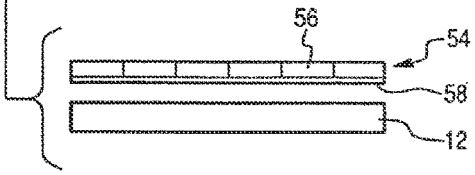


Fig. 9

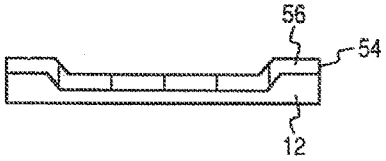


Fig. 10

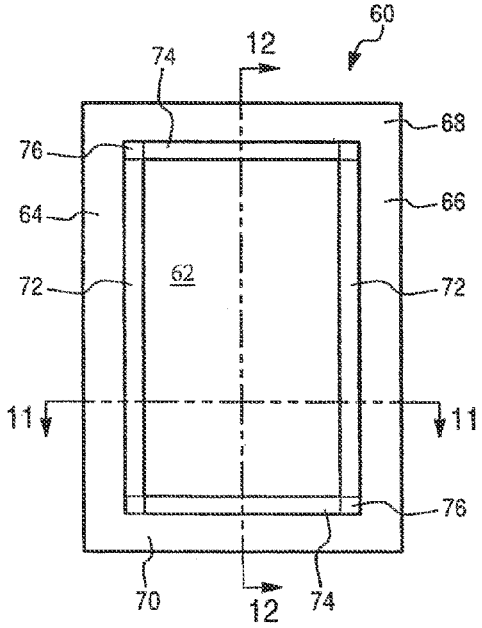


Fig. 11

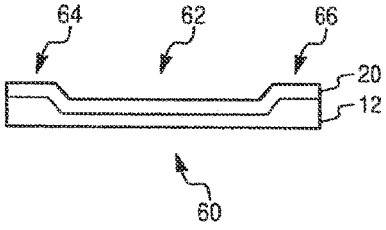


Fig. 12

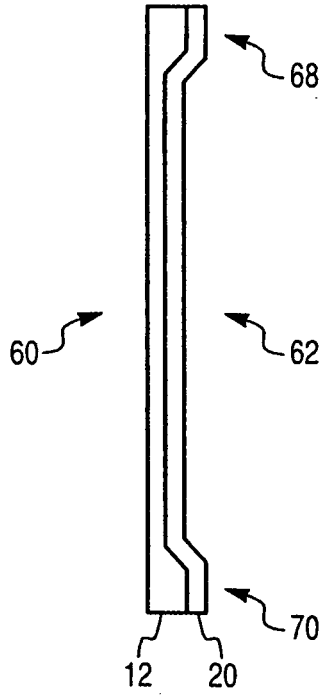
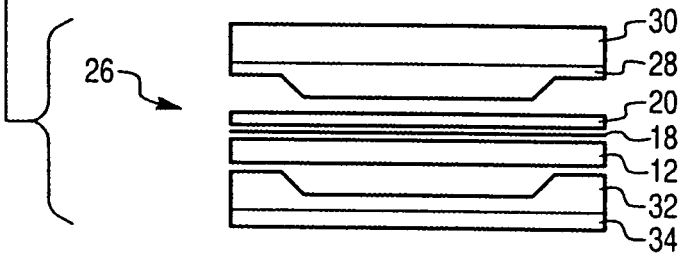


Fig. 13



DECORATIVE DOOR SKIN COMPOSITE ARTICLE

CROSS-REFERENCE TO RELATED APPLICATION AND CLAIM TO PRIORITY

This application is a divisional of application Ser. No. 10/291,757, filed Nov. 12, 2002, now U.S. Pat. No. 7,195,686, the disclosure of which is incorporated herein by reference and to which priority is claimed.

FIELD OF THE INVENTION

The present invention is directed toward a method of forming a molded panel having a decorative surface and to the molded panel formed by this method, and, more specifically, toward a method of attaching a decorative layer, such as a wood veneer, a foil, or a non-creped paper, to a substrate in a pressing operation that deforms both the substrate and the decorative layer to produce a panel having a substantially unblemished, finished surface and to the panel formed by this method.

BACKGROUND OF THE INVENTION

Many products that have heretofore been manufactured from natural wood are now formed from composite materials that include fibers obtained from wood or non-wood sources. For example, composite panels may be formed by coating a quantity of fibers with a heat curable resin binder, placing a loose mat of these coated fibers in a press, and applying heat and pressure to the mat to reduce its thickness and cure the resin, thereby producing a thin, wood-like board. Such boards may be referred to as "chip board" or "fiber board," depending on the source of the fibers used in their manufacture, and fiberboards, in turn, may be referred to as softboard, medium density fiberboard (MDF) or hardboard, depending on their densities. These boards are sometimes attached to rectangular frames to form doors, and, when used in this manner, are referred to as "door skins." When such panels are formed with flat surfaces, they are often referred to as "flush" panels or "flush" door skins; when they are formed with a pattern of depressions, to simulate the appearance of a traditional rail and stile door having panels, for example, they are often referred to as "molded" panels or "molded" door skins.

While fiberboard panels have a hardness and flexibility similar to sheets of natural wood, their surfaces lack the grain and texture of natural wood, and are therefore generally not suitable for use in applications where a natural wood appearance is desired. Rather, fiberboards generally must be painted or otherwise covered to produce a finished surface. If a fiberboard panel having a wood grain appearance is desired, a layer of covering material must be applied. The layer of covering material may be a natural wood veneer or a paper, foil, or film printed with a wood grain pattern. These layers of covering material are applied in a process separate from the panel forming process, using a membrane press, for example. This additional manufacturing step, however, increases the cost of such products.

Manufactured wood products, such as the flush door skins mentioned above, may be transformed into non-planar products, such as molded door skins, by placing them into presses and subjecting them to heat and pressure. A process for transforming fiberboard panels is known from U.S. Pat. No. 6,073,419, for example, which patent is hereby incorporated by reference. This patent teaches that resin impregnated crepe paper can be placed into the press while a flush panel is deformed. The creping allows the paper to stretch and deform along with the panel and provides a moisture barrier for use in water resistant applications.

The heat and pressure required for changing the shape of the flush panel have in the past required the use of a creped paper layer. Non-creped paper tended to tear and wrinkle and produce a surface that required further processing to make it acceptable as a finished surface. Prior art papers used to affect surface properties are generally creped or otherwise textured to allow them to expand with the changing surface area of the flush panel as it deforms. Therefore, they do not produce a uniformly colored surface when the article is removed from the press. Articles formed in this manner must be painted or otherwise covered to hide the wrinkles, stretch marks, and irregularity in the surface color finish.

It is therefore desirable to produce a decorative, finished surface on a panel of composite material during an operation that forms a flush panel into a molded panel.

SUMMARY OF THE INVENTION

A first aspect of the present invention comprises a method of forming a composite article that involves providing a press having first and second platens, a cellulosic fiber substrate having a first thickness and a layer of material such as wood veneer, foil, or non-creped paper. The layer of material has a thickness less than the thickness of the cellulosic fiber substrate. A bonding material is applied to the cellulosic fiber substrate or to the layer of material, and the layer of material is placed onto the cellulosic fiber substrate so that the bonding material is between the layer of material and the substrate. Next, the substrate and layer of material are placed between the first and second press platens, and at least one of the platens is moved toward the other one to deform the cellulosic fiber substrate and layer of material into a predetermined configuration and bond the layer of material to the cellulosic fiber substrate without cracking or wrinkling the layer of material. Another aspect of the invention is a product made by this method.

A further aspect of the invention comprises a composite article including a layer of MDF having a first surface and a layer of veneer bonded to the first surface. The first surface is deformed under the application of heat and pressure while in contact with the layer of veneer to form a sharp edge in the veneer layer.

Another aspect of the invention comprises a method of forming a composite article that involves providing a press and an MDF substrate having first and second sides, and placing a flat sheet of wood veneer on the first side of the MDF substrate, then placing the MDF substrate and wood veneer overlay into the press. The press is closed to simultaneously deform the MDF substrate and wood veneer and bond the wood veneer to the MDF substrate to create a composite article.

A further aspect of the invention comprises a composite article that includes a deformed sheet of MDF and an uncracked, deformed layer of wood veneer bonded to the deformed sheet of MDF. The uncracked, deformed layer of wood veneer has a moisture content of less than about 2 to 4 percent.

An additional aspect of the invention is a method of forming a molded panel having a natural wood surface that involves providing a press having first and second platens for deforming sheets of wood composite material and providing a flat sheet of wood veneer. Next, a sheet of wood composite material is heated and moisturized, and a layer of bonding material is applied to either or both of the heated and mois-

turized sheet of wood composite material and the flat sheet of wood veneer. The flat sheet of wood veneer is placed onto the heated and moisturized sheet of wood composite material, and then the wood composite and veneer are placed into the press between the first and second platens. At least one of the first and second platens is moved toward the other of the first and second platens to deform and bond the MDF and the wood veneer into a finished article. The finished article is removed from the press and then wetted to raise the moisture content of the wood veneer to prevent the veneer from deforming or causing the wood composite panel to bow or cup.

An additional aspect of the invention comprises a method of forming a composite article having a finished surface that involves providing an MDF substrate having first and second sides and a surface area and laying a sheet of material having the same surface area on the first side. The MDF substrate and sheet of material are placed into a press, and the press is closed to simultaneously deform the MDF substrate and the sheet of material and bond the sheet of material to the MDF without forming wrinkles in the sheet of material.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood from a reading of the detailed description provided below in connection with the following drawings.

FIG. **1** is a top plan view of a panel formed according to the present invention.

FIG. **2** is an exploded end elevational view of the panel of FIG. **1**.

FIG. **3** is a cross-sectional view taken through line **3-3** of FIG. **1**.

FIG. **4** is a top plan view of a second embodiment of a panel formed according to the present invention.

FIG. **5** is an exploded end elevational view of the panel of FIG. **4**.

FIG. **6** is a cross-sectional view taken through line **6-6** of FIG. **4**.

FIG. **7** is a top plan view of a third embodiment of a panel formed according to the present invention.

FIG. **8** is an exploded end elevational view of the panel of FIG. **7**.

FIG. **9** is a cross-sectional view taken through line **9-9** of FIG. **7**.

FIG. **10** is a top plan view of a fourth panel formed according to the present invention.

FIG. **11** is a cross-sectional view taken along line **11-11** of FIG. **10**.

FIG. **12** is a cross-sectional view taken along line **12-12** of FIG. **10**.

FIG. **13** is a schematic sectional view of a press for use in forming the panels of the subject invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings, wherein the showings are for purposes of illustrating preferred embodiments of the invention only, and not for purposes of limiting same, FIGS. **1-3** illustrate a panel **10** formed from a first substrate **12**, such as medium density fiberboard (MDF), having a lower surface **14** and an upper surface **16**, a layer of adhesive **18**, which may be a thermosetting resin or adhesive, such as a urea-based resin or adhesive, preferably melamine-urea-formaldehyde resin or urea-formaldehyde resin or paper impregnated melamine, for example, and a covering layer **20** having a lower surface **22** and an upper surface **24**. Covering layer **20** may comprise a wood veneer, a foil, or a non-creped paper material which may be plain or bear a printed or other design or image.

Panel **10** is formed by placing adhesive **18** on substrate **12**, placing covering layer **20** on top of the adhesive **18** and placing the article thus formed into a press **26**, illustrated in FIG. **13**, having an upper die **28** attached to an upper platen **30** and a lower mold cavity **32** attached to a lower platen **34**. To make substrate **12** easier to deform, it is preferably heated and moistened before the covering layer **20** is attached in the manner taught in WO 98/48992, which is hereby incorporated by reference. One of the platens **30**, **34** is moved toward the other to close the press **26**, and heat and pressure are applied to the article in the press **26** until it assumes the profile illustrated in FIG. **3**. Pressure is applied cyclically in the manner taught in WO/9848992, at a constant rate, or at a constantly increasing rate. The press **26** may be vented during the pressing operation to release steam and other volatile materials generated during the pressing operation. The heat of the press **26** both keeps the substrate **12** at a temperature at which it is deformable and cures adhesive **18** to bond the covering layer **20** to the substrate **12**.

The heated and moistened substrate **12** enters the press **26** with a moisture content of about 10-12 percent by weight and exits with a total moisture content of about 5 to 7 percent by weight. When covering layer **20** is a wood veneer, it cannot be preheated and moistened in the same manner as the substrate **12** without warping or bowing the veneer. However, if the veneer is placed into the press **26** without pre-moistening, it emerges at a very low moisture level, less than 2-4 percent, for example, and soon deforms, ruining the surface appearance of the panel **10**. Therefore, it has been found necessary to moisturize the panel **10** when it is removed from the press **26**, to increase the moisture content of the veneer to prevent the veneer from deforming. This may be done, for example, by spraying water on the panel **10**. Surprisingly, it has been found that this moisturizing step prevents the veneer from deforming and does not adversely affect the properties of the panel **10**. The panel **10**, after moistening will have a moisture content of about 7 percent. When covering layer **20** is a foil or a non-creped paper, the post-pressing moisturizing step may be omitted.

Preferred veneers include those comprising cherry or mahogany, although many different woods provide satisfactory results. Furthermore the thickness of the veneer is preferably in the 0.3 to 0.9 mm range, most preferably about 0.6 mm. A preferred adhesive **18** is a melamine impregnated sheet of paper.

Because the substrate **12** and covering layer **20** are deformed in the same step by the same molds, the lower surface **22** of the covering layer **20** will correspond almost exactly to the upper layer **16** of covering layer **20**. This allows the adhesive **18** to securely bond these two layers **12**, **20**, and helps ensure that the substrate **12** supports the somewhat fragile covering layer **20** over its entire surface. Moreover, when covering layer **20** is a layer of wood veneer, the heat of the press **26**, and the moisture released in the press **26** during the pressing operation, help mold the outside surface of covering layer **20** and form a sharper edge than would have been possible had a wood veneer covering layer been attached to a previously molded substrate. This simultaneous deformation produces a panel having better fidelity and sharper definition that was typically obtained from prior art processes.

Panel **10** formed by this process includes an upper surface **36** having first and second planar side portions **38**, **40** and a central planar portion **42** therebetween, as shown in FIG. **1**. A first angled wall **44** extends between first planar side portion

38 and central portion 42 and connects to first planar side portion 38 at a first corner 45 and to central portion 42 at a second corner 46. The distance between the plane of the first and second side portions 38, 40 and the plane of the central planar portion 42 is preferably about 6-9 mm. It is believed that deforming the panel 10 in one direction only, namely in a direction parallel to the length of corners 45, 46, helps reduce the likelihood that the covering layer 20 will deform, wrinkle or crack. When covering layer 20 is a wood veneer, the veneer should be applied to the substrate 12 with its grain direction aligned with the direction of deformation, that is aligned with corners 45 and 46.

When covering layer 20 is a non-creped paper or foil, it may include a printed pattern, such as wood grain, inlaid tiles, or a detailed graphic or artistic image. Because the covering layer 20 is not creped, the product leaves the press with a finished surface, and any image on that surface is not torn, wrinkled, or distorted.

FIGS. 4-6 illustrate a panel 50 according to a second embodiment of the present invention. Elements common to both embodiments are identified with the same reference numerals. Panel 50 includes a substrate 12 and a covering layer 51 comprising a wood veneer having a paper backing 52. This paper backing 52 is present on many commercially available veneers. The paper backing 52 helps maintain the integrity of the veneer when pressed and reduces the likelihood that the veneer will crack during pressing. The use of paper backing 52 may allow for greater offsets between the plane of side portions 38, 40 and the plane of a center area 43 of the panel 50. Furthermore, the paper backing 52 may incorporate a heat activated bonding agent that will bond the covering layer 51 to the substrate 12 during pressing, eliminating the need for a separate adhesive applied to the substrate. Alternately, a separate bonding agent, such as a liquid adhesive or a resin impregnated paper sheet, could be used to join the paper-backed covering layer 51 to substrate 12. Panel 50 is formed by pressing the covering layer 51 with paper backing 52 and substrate 12 in a press 26 as discussed above. Veneers having backings in the form of meshes or scrims or fabrics or layers of fusible material are also commercially available and may be used in the present invention as well.

FIGS. 7-9 depict a panel 53 according to third embodiment of the present invention. Elements common to previous embodiments are identified with the same reference numerals. In this embodiment, a covering layer 54 comprising a plurality of strips 56 of wood veneer secured together by a paper backing 58 is used. The strips 56 are preferably about six inches wide. The use of joined-together strips 56 may provide a covering layer 54 having improved flexibility in the direction of the length of strips 56 and allow the covering layer 54 to flex when pressed with less chance of cracking or warping.

FIGS. 10-12 depict a fourth embodiment of the present invention wherein a panel 60 includes a depressed central portion 62 surrounded by first and second planar side portions 64, 66 a planer top portion 68 and a planar lower portion 70. First and second sloped walls 72 connect first planar side portion 64 to central portion 62 while third and fourth sloped walls 74 connect the top portion 68 and bottom portion 70 to the central portion. The slope of the third and fourth sloped walls 74 is less than the slope of the first and second sloped walls 72 to minimize cracking when covering layer 20 is a wood veneer and to minimize wrinkling and/or tearing when covering layer 20 is a foil or paper. In addition, the transition areas 76 between the first and second sloped walls 72 and the third and fourth sloped walls 74 are smooth and gradual, as seen in FIG. 10, which further reduces the cracking or wrinkling that would likely occur if these sloped walls 72, 74 met at sharp angles.

The present invention has been described above in terms of several preferred embodiments. However, it should be understood that may obvious modifications and additions to these embodiments will become apparent to those skilled in the art after reading this disclosure. For example, while the invention has been described as primarily useful in connection with fiberboard, it could also be practiced on other materials such as fiberglass. Moreover, the panels formed by this method can vary in shape and configuration and might be useful, for example, as baseboard. It is intended that all such obvious modifications and additions form a part of this invention to the extent that they are included within the scope of the several claims appended hereto.

We claim:

1. A composite non-planar door skin comprising:

a medium density fiberboard defining a continuous layer having an exterior major surface comprising a planar central portion extending along a first plane, a first planar side portion and a second planar side portion positioned at opposite first and second sides of the planar central portion and extending in a second plane, a planar top portion and a planar lower portion positioned at opposite third and fourth sides of the planar central portion and extending in said second plane, where the second plane is spaced apart from the first plane, a first angled wall connecting the first side of the planar central portion to the first planar side portion, a second angled wall connecting the second side of the planar central portion to the second planar side portion, a third angled wall connecting the planar top portion with the third side of the planar central portion, and a fourth angled wall connecting the planar lower portion with the fourth side of the planar central portion, wherein the third angled wall and the fourth angled wall have a slope that is less than a slope of the first and second angled walls;

a wood veneer layer covering the exterior major surface of the medium density fiberboard, the wood veneer layer comprising a planar central portion, planar side portions, and angled walls corresponding to and overlaying the planar central portion, the first and second planar side portions, the planar top portion, the planar lower portion, and the first, second, third, and fourth angled walls of the medium density fiberboard,

wherein the medium density fiberboard and the wood veneer layer are bonded to one another and simultaneously deformed into the composite non-planar door skin without cracking or wrinkling of the wood veneer layer by heating and moisturizing the medium density fiberboard but not the wood veneer layer, placing the medium density fiberboard and the wood veneer layer in contact with one another in a press, deforming and bonding the medium density fiberboard and the wood veneer layer together under application of heat and pressure to form the composite non-planar door skin, removing the composite non-planar door skin from the press, and wetting the composite non-planar door skin to raise the moisture content of the wood veneer layer.

2. The composite non-planar door skin of claim 1, wherein the medium density fiberboard and the wood veneer layer are deformed in a thickness direction of the composite non-planar door skin.

3. The composite non-planar door skin of claim 1, wherein the wood veneer layer has a grain direction, and the medium

density fiberboard and the wood veneer layer are deformed along a direction that is the same as the grain direction.

4. The composite non-planar door skin of claim **1**, wherein the medium density fiberboard and the wood veneer layer have a rectangular shape, wherein the first and second angled wall portions connect the planar central portion to the first and second planar side portions, respectively, the third and fourth angled wall portions connect the planar central portion to the planar top portion and the planar lower portion, respectively, and wherein the first plane is parallel to the second plane.

5. The composite non-planar door skin of claim **4**, wherein the first plane and the second plane are spaced apart from one another by 6-9 mm.

6. The composite non-planar door skin of claim **1**, wherein the wood veneer layer has a thickness in the range of 0.3 mm to 0.9 mm.

7. The composite non-planar door skin of claim **1**, further comprising a layer of bonding material disposed between the medium density fiberboard and the wood veneer layer.

8. A composite non-planar door skin comprising:

a medium density fiberboard defining a continuous layer having an exterior major surface comprising a planar central portion extending along a first plane, a first planar side portion and a second planar side portion positioned at opposite first and second sides of the planar central portion and each extending in a second plane that is spaced from the first plane, a first angled wall connecting the first side of the planar central portion to the first planar side portion, and a second angled wall connecting the second side of the planar central portion to the second planar side portion;

a wood veneer layer in the form of a plurality of wood veneer strips covering the exterior major surface of the medium density fiberboard, the plurality of wood veneer strips overlying the planar central portion, the first planar side portion, the first angled wall, and the second angled wall of the medium density fiberboard, wherein the first angled wall extends an entire length of the medium density fiberboard and is covered by a first wood veneer strip and the second angled wall extends the entire length of the medium density fiberboard and is covered by a second wood veneer strip; and

a paper backing between the medium density fiberboard and the wood veneer layer,

wherein the medium density fiberboard, the wood veneer layer and the paper backing are bonded to one another and simultaneously deformed into the composite non-planar door skin without cracking or wrinkling of the wood veneer layer by heating and moisturizing the medium density fiberboard but not the wood veneer layer, placing the medium density fiberboard and the wood veneer layer in contact with one another in a press, deforming and bonding the medium density fiberboard, the paper backing, and the wood veneer layer together under application of heat and pressure to form the composite non-planar door skin, removing the composite non-planar door skin from the press, and wetting the composite non-planar door skin to raise the moisture content of the wood veneer layer.

9. The composite non-planar door skin of claim **8**, wherein the paper backing incorporates a heat activated bonding agent.

10. The composite non-planar door skin of claim **8**, wherein the plurality of wood veneer strips comprises a first wood veneer strip and a second wood veneer strip, wherein an edge surface of the first wood veneer strip is directly adjacent to an edge surface of the second wood veneer strip in side-by-side arrangement.

11. The composite non-planar door skin of claim **8**, wherein more than one wood veneer strip of the plurality of wood veneer strips overlay the planar central portion of the medium density fiberboard.

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